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ABSTRACT

The debate over whether primates can be taught visual language is examined, and evidence of use of nonverbal language in primate studies is compared with the language criteria of a number of linguistic researchers. Background information on language, visual language (including sign language), and the parameters of the studies is offered, including oral and human language criteria, conception of grammar, and use of word symbols (chip symbology). The performance of four apes in different studies, using different methods to teach visual language, is then examined in terms of these parameters. It is concluded that the apes can mentally manipulate abstract concepts that have been defined by means of an arbitrary code, and that this manipulation involves mentally scanning a set of symbols and cognitively selecting one on the basis of its specific linguistic context. Ape results proved to be linguistically coded and expressed, establishing true linguistic comprehensive production. Despite the fact that the ape linguistic abilities were far below the level of adult communication, the apes did spontaneously create word order units and combine familiar terms into new ones. It is concluded that based on these results, apes possess inherent rudimentary language potential. (MSE)

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ED 385 148

# Can Human-Taught Primates Produce A Non-Verbal Language?

Note: The original draft was presented for a graduate course entitled, "Bio-cultural Foundations of Language."

by James A. Jaramillo, MA

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## *Abstract*

Can human-taught primates proficiently produce a visual language? During the 1960's and 1970's, American Social Scientists, such as Keith Hayes and Herb Terrace, attempted to teach primates the human verbal language. These attempts failed, while earlier research (Duckworth 1910; Huber 1931; and Kummer 1953) indicated that primates lack the vocal anatomy of humans. In search of an alternative language, the Gardners proposed the use of a visual language, and began to teach a chimpanzee named Washoe sign language. Others, such as Premack, Fouts, the Rumbaughs, and Patterson followed the Gardners stance, and began to teach primates a visual language. Critics of Primate visual language proficiency, such as Terrace and Brown, began to challenge the results of the Gardners, et al. and the ape language controversy evolved. The purpose of this paper is to determine whether human taught primates can produce a human constructed language. To address this query, I compared these primates' use of a visual language with the language criteria of Brown (1974), Liddel (1980), Bornstein and Saulnier (1986), and Dore (1973).

# Table of Contents

Abstract . . . . . .

Introduction . . . . . 1

Background and Overview . . . . . 2

Research Query . . . . . 3

Goal . . . . . 4

Objectives . . . . . 4

Hypothesis . . . . . 5

Methodology . . . . . 5

Critics . . . . . 6

Context of Limitations . . . . . 6

Oral Language Criteria . . . . . 7

Grammar . . . . . 8

Hockett's Human Language Criteria . . . . . .9

The Visual Languages. . . . . 9

Washoe and Ameslan . . . . . 16

Koko . . . . . 17

Sign Language . . . . . 18

Koko and Ameslan . . . . . 29

Sarah and Chip Symbology . . . . . .41

**The Lana Project** . . . . . 59

**The Findings** . . . . . .67

**Conclusions** . . . . . 67

## *INTRODUCTION*

During the 1960's and 70's, American social scientists, such as Keith Hayes, attempted to train primates to use a natural human verbal language. Nevertheless, several earlier studies (Duckworth 1910; Huber 1931; and Kummer 1953) indicated that the great apes (the orangutan, gorilla, and chimpanzee) lack three of the anatomical features that enable man to produce verbal language. This is evident in that man's specific facial features such as the face, lips, and the mouth enable him to produce a distinct range of speech sounds (Lenneberg 1967). Thus, various researchers such as the Gardners, taught the great ape to comprehend a number of different visual languages. These include the American Sign Language (ASL) and the independently developed ape languages of the lexigram and chip symbology. Washoe and Koko were taught American Sign Language (ASL) while Sarah learned chip symbology, and later lexigrams, which Lana was similarly instructed in.

## *BACKGROUND AND OVERVIEW*

The distinction between human phonalized language and ape visual communication was first proposed in Charles Hockett's (1960) "Origins of Speech" which lists language's thirteen human properties; they are: arbitrariness, interchangeability, specialization, displacement, cultural transmission, the vocal auditory channel, broadcast transmission and directional reception, rapid fading, complete feedback, semanticity, discreteness, productivity or openness, tradition and duality of pattern. Hockett (1967) later added to his list prevarication, learnability, and reflexiveness which together comprised a total of 16 human language designs

(prerequisites). Hockett (1967:6) states that "nine of the sixteen designs are present in the primate's natural vocal-auditory communication." The primates then, lack six of Hockett's language designs which inhibit the ape's natural language from being classified as a legitimate human language equivalent. Linden (1974:151) notes that "These six exclusionary designs include duality of pattern, arbitrariness, productivity, interchangeability, displacement, and cultural transmission." Fortunately, several apes were trained in visual languages that in themselves fulfilled many of Hockett's remaining language criteria. These design features appear in the languages of the apes' named Washoe, Sarah, Lana and Koko, who are generally considered among the most linguistically proficient apes in the field of primatology. It is evident that one merely needs to find evidence supporting all four apes' proficiency in Hockett's remaining designs in order to endorse the legitimacy of a human induced-rudimentary language; yet this proposal is circumvented by many of Hockett's preconceived assumptions. These preconceptions are apparent in many of Hockett's design features which accordingly were developed to distinguish human verbal language from the communicative system of the other less intellectually inclined animals.

Nevertheless, visual languages such as Ameslan are just as functionally competent which makes their criteria comparable to the language design prerequisites of Hockett. Nevertheless, Hockett should not be held accountable for the ape's ability to learn these visual languages since the first results of primate sign language competence predates his language design features. They appeared in

the early 1970's, when the chimp Washoe began signing in Ameslan. Hockett; however, should not have discriminated against sign language, which is implied in his design features which placed emphasis on distinguishing human oral language from that of the animal kingdom. This oversight is compounded further by his assumption that human language's features are distinct from that of the upper apes. In short, this assumption is a species-centric statement that places humans at the pillar of all the species that inhabit the earth. Secondly, Hockett's species superiority view is further attested to by the fact that this assumption was espoused by a human. Human-centric view such as this are challenged by Rachels (1990) who asks why should humans consider themselves so special or unique from other species. According to Rachels, those who posit that qualities such as language use, ability to rationalize, and choice are solely attributable to humans are neglecting to see that these qualities are differentiated by degree across species, rather than by kind. For instance, humans were believed to be the only tool makers in the world until findings by primatologists indicated that apes use tools. For example, humans use the drill tool to obtain core samples of the earth, while chimpanzees insert twigs into termite holes to retrieve and consume them.

## *RESEARCH QUERY*

The purpose of this paper is to determine whether human taught primates can produce a human constructed non-verbal language. (This is not to suggest that primates can replicate non-verbal human language, which is not possible given the apes' coordination and vocal anatomy which differ from that of the human.) The question then is

to what extent can primates form coherent language via enculturation in human taught non-verbal languages.

### *GOAL*

Although Hockett's designs are species-centric, I will employ them as the outline of this paper because they facilitate the goal of this paper, which is to compare the language abilities found between human and human assisted ape language skills.[1] To do this, I utilize linguists Victoria Fromkin and Robert Rodman's (1983) human language description to augment Hockett's designs throughout much of this paper's independent assessment of each ape language.

### *OBJECTIVES*

The main objective is to compare how human taught primates' nonverbal communication systems correspond with human language criteria. Washoe and Koko's level of ASL proficiency is evident via a comparative analysis with human ASL criteria and child linguistic studies. Their sign language competence was examined by following the ASL criteria of Liddell (1980) and Bornstein and Saulnier (1986). Sarah's linguistic competence was compared to her fulfillment of Premack's language exemplars. Lana's was tested against the language criteria of her instructors' Sue Savage and Duane Rumbaugh who adopted techniques from ASL and Chip symbology.

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[1] Thus, we may yet have to amend Hockett's language characteristics.

## *HYPOTHESIS*

I propose that with proper training apes can master many of the rudiments of symbolic communication and syntax. This level of ape visual language corresponds with that of a 2-3 year old speaking child. This became evident in the research conducted by the Patterson (1986) and the Gardners (1971), in Patterson's (1986) use of Dore's (1973) research, and in the Gardners employment of Brown's acquistion stages. The Gardners research simultaneously found language developmentary parallels between young children, and Koko and Washoe.

## *METHODOLOGY*

Rudimentary ape language is evident in an analysis comparing how the linguistic skills found between each ape's visual language separately meets the prerequisites of human sign language. Koko and Washoe's ASL performance will be compared with the ASL of humans, and the above mentioned researchers' child linguistic stages. Sarah's linguistic proficiency will be correlated with Premack's chip symbology and Lana's with Rumbaugh's application of Von Glaserfeld's Yerkish language. In addition, a synthesis of Fromkin and Rodman's (1983) language criteria with Hockett's language description will be employed throughout the findings of these primate linguistic studies. Nevertheless, there were a number of critics who raised issues about the linguistic proficiency of these primates. Hence, the topics controvertialness implores that I address these critics' remarks towards primate language.

***CRITICS.*** Terrace (1974) and Brown (1973) critiqued various aspects about these primates' linguistic ability. For instance, as an opponent of ape language ability, Terrace (1974) applied his unsuccessful chimp's linguistic performance to Washoe's linguistic skills and subsequently presented his findings while at the Dahlem Conferences. As a result of his findings, Terrace's conclusions caused many universities to decrease or terminate primate language funding. Brown (1973) was the next critic to scrutinize ape language ability. Brown concluded that Washoe and Sarah's developmentary language stages were not full-proof. We fully address Terrace and Brown's remarks in the body of this paper.

## *CONTEXT OF LIMITATIONS*

The discussion of human language and thought in contrast to primate visual language is very controversial since few language disciplines agree on a common definition of human language. They do; however, agree that man is the only animal with a naturally produced language. Thus, we (as humans) tend to define language criteria on a human basis only. For example, the definitive phoneme is unique to man and therefore distinguishes human language from animal communication. Nevertheless, as Hockett (1959:37) posits "it is not a necessary condition for language." According to Premack (1976:37), "no syntactic or semantic distinction depends on whether the primitive level of language is the word or an element below the word." Hence, to apply solely human characteristics to language is surely species-centric. Nevertheless, human language and its corresponding characteristics are the only available sources which we may utilize to undertake this comparative analysis, because they

are our creation and baseline. Moreover, since humans are considered to be the most effective communicators, it follows that we should define the features than constitute our unique oral language.

### *ORAL LANGUAGE CRITERIA*

According to Fromkin and Rodman (1983:114), "Human oral language is dependent on the phonological hierarchical relationship of the phoneme-morpheme-syntax-grammar." Phonemes are the minimal units of sound that construct a morpheme (word); they are associated with the alphabet's written letters. Hence, the word man is a meaningful unit (morpheme) encompassing three minimal units of sound-M,A,N. The word is composed of one or two morphemes that are either bound or unbound. For instance, suffixes and prefixes are considered bound since they cannot stand alone while free morphemes such as you, sleep, and paper can constitute words by themselves. Man's limited memory and ability to produce discriminately different phonological responses discouraged him from devising a different response for each word. "Man instead created only about fifty or more phonemes and arbitrarily combined them in various orders to describe his world"(Premack 1976:37). Fromkin and Rodman (1983:28) state "it is the way in which these meanings and sounds are related that is called semantics". "The sounds and meanings of words are arbitrarily related, that is if you had never heard of the word "book" you would not by its very sounds, know what it meant"(ibid). A series of two or more of these morphemes form a sentence. The rules a speaker utilizes to produce and comprehend these sentences is known as syntax. The above

linguistic features comprise grammar which represents the linguistic knowledge(competence) and capacity of its speakers(performance). ***GRAMMAR.*** Grammar includes the basic sounds, words, and rules used in the formation, pronunciation, and interpretation of sentences"(Fromkin and Rodman 1983:18). There are two types of grammar: descriptive and prescriptive. Descriptive grammar is the cognitive grammar known among speakers of a language. It describes the known rules rather than instructing them, which prescriptive grammar entails. Prescriptive grammar is considered the dialect used by the upper socio-economic classes, the dialect used in literature, school, and the media. I apply prescriptive grammar as the model for this paper's comparative analysis since a descriptive emphasis is not feasible (given the extant communication barriers between primates and humans). A prescriptive orientation enables us to focus on the more mundane elements which are more readily understood than the descriptive ones. The prescriptive approach is defined by psycho linguist Lenneberg (1967:271) who states that language consists of elemental invariant units, that is speech sounds, or words, and words that are put together to form sentences. Speech sounds have no meaning, but words do. They acquire meaning by an associative process in which the visual image of an object is linked with the sound of a word." With respect to sign language, phonemes are equivalent to cheremes, while words are equivalent to ideographic hand signs.

### *HOCKETT'S HUMAN LANGUAGE CRITERIA*

Grammar is related to Hockett's (1960) productivity design which is demonstrated when one makes new meaningful utterances from older, familiar ones. This design describes our ability to progressively produce an infinite number of new words and sentences from a vocabulary's limit. For instance, if a subject did not know the word for a blender yet heard and visualized its function, he could effectively call it a mixing vessel which does signify a blenders denotative function. Thus, a mixing vessel could hypothetically replace the word for blender.

The next associated language characteristic is known as Hockett's (1960) displacement design which is defined as the discussions of things remote in time and/or space. This feature is evident in the following sentence: "I will go home tomorrow". The word tomorrow (temporal) and home (thing) are being referred to as an event that will occur during the next day, a statement removed from the time and place of its origins. Nevertheless, these presented human oral language characteristics differ from that of the visual languages. Both; however, do demonstrate many similar linguistic fundamentals.

### *THE VISUAL LANGUAGES*

For example, ape visual languages are ideographic in nature with the exception of ASL' s finger signs which act as phoneme equivalents called cheremes and which are primarily utilized to individually sign names, places, and things. Ideographic symbols(pheremes), like human oral language, signify concepts or words . The ape visual languages produce these ideographic symbols in three different forms. For instance, the ASL apes: Washoe and

Koko use distinct palm orientations to form signs while Sarah places metal plastic colored chips on a magnetized board; and Lana presses keys in the form of nine geometric shapes arranged on a large wall panel.

All three languages primarily consist of arbitrary shapes. ASL's iconographic symbols encompass anywhere from 13-25% of the total language (Linda Remmel 1987, Personal Communication). Erik Von Glaserfeld's lexigrams are randomly reversed left to right, or inverted with no configurational changes which prevents the appearance of iconography (Rumbaugh 1986:48). Premack's (1976:44) chips are also uniconographic, since they vary in shape, size, texture, and color.

All three language users formulate sentences differently. The ASL signers produce their hand and facial gestures in front of the chest while Lana, presses her panel keys horizontally left to right onto a screen, and Sarah, places her magnetized symbols in Chinese fashion-vertically from top to bottom-upon a metal board. Their grammar also involves three different modes of production. The signers rely on their memory of mental/visual images to create coherent sentences. On the other hand, Sarah, was always visually presented with the choice of either selecting one chip from a set of two or too organize four-five chips in given sequences; which obviously required less visual memory retention. Lana's ideographic choices were also visually present on a keyboard and similarly involved less memory.

Ape and human linguistic affinities also appear in many of Hockett's designs. The rapid fading and broadcast transmission and directional reception designs are offshoots of the vocal-auditory component which in itself denotes an exclusive human verbal language feature. For instance, the *vocal auditory* design states that oral language is produced by the vocal tract and received by the ear. Ironically, Hockett excludes signing yet visual languages are just as capable of producing the same communicative results. For example, ASL's signs, Premack's chips, and Rumbaugh's lexigram keys like human verbal language can formulate equivalent grammatical attributes such as words, sentences, etc. The only feature that possibly indicates human superiority is the fact that oral language frees the hands for other tasks.

The next language feature-Hockett's(1960) *rapid fading* design refers to the transitory nature of the heard signal which persists for only a short duration. The hand signal, chip, and lexigram key are similarly capable of lasting only a short temporal period, depending upon the individual; yet all three of these languages produce a visual image that usually lasts longer than an oral reply. Effective communication relies on the temporal nature of all signals, whether verbal or not. Rumbaugh's lexigram language requires ample discourse time since the instructor must key in a question and then wait for the chimp's response. Thus, Lana's response depends upon how quickly she presses the encoded message into the lexigram machine. Koko and Washoe's speed duration is determined by the individuals competence yet this signing can never match oral languages maximum production rate. In Premack's language, chips

function in the form of exemplars which remain on the magnetized board until Sarah replies which consumes much more time than a phonal system. Nonetheless, all of the apes can produce Hockett's rapid fading design.

The next Hockett design (1960) is known as the broadcast transmission and directional reception feature. This feature states that a linguistic signal can only be heard by those within hearing range and infers that , unlike sign language, this message transmits to all directions from one source. Sign language of course is visually oriented and thus may only be comprehended by those within the signee's viewing span. Nevertheless, The signee is understood by everyone within visual range and I conclude that it would be unfair to deny sign language's ability to meet this design on the basis of its limited peripheral visual emphasis. Lana's reception and transmission is limited to her board while Sarah likewise visually receives and transmits her signs on a computer screen.

Hockett's(1960) total feedback feature implies that the speaker hears anything relevant that he says. Ameslan involves signing in front of one's chest which is of course within visual range of the signer. The sign language trained-apes similarly produce their signs in front of their chest. ASL ape signers of course cannot view their own non-manual signals such as facial gestures and head movement yet these characteristics are hopefully controlled by the subject during their appropriate connotative context. Moreover, Sarah, is able to visualize her magnetized board while Lana's monitor is also located directly in line with her vision.

The next design, discreteness, emphasizes English's utilization of less than 50 sounds which notes the relatively small number of sounds used in human verbal language. ASL only displays this feature in its finger signs which again are used to indicate names, places, and numbers. Discreteness, also entails the break-up of messages into separate units. Thus, English's sentences hierarchically digress into words and then sounds(phonemes). ASL also demonstrates this sequence of sentences, words, and letters. Premack's chips and Rumbaugh's lexigrams with the exception of letters can similarly be broken down from sentences to morphemes.

Hockett's(1960) *specialization* design involves "spreading sound waves to function only as signals." The visual languages of course have to rely on visual symbols to communicate. These signals in themselves have no direct physical effect upon the converser(s) or his environment. For example, the word "jump" does not decrease the temperature in the speaker's environment nor does it force anyone to comply with the command itself. As a verbal characteristic, this language design is exclusive to human verbal language and is species centric; therefore, this is not a universal characteristic of language (verbal and nonverbal forms). Consequently this design does not apply to all three visual ape languages and is therefore not an objective criterion of language.

Nevertheless, all three primate languages fulfill the interchangeability design which states that "every language speaker is both a transmitter and receiver of linguistic message"(Hockett 1966). For instance, during conversation, the ASL apes both receive a sign(s) from their trainers and respond with a sign(s) which

actingly corresponds with receiving and transmitting. Sarah, likewise, transmits and receives messages during conversations. She produces utterances by placing symbols on a board before or after receiving the instructor's intended message. Lana generates messages on a computer screen via a keyboard and similarly receives them on the same screen. Thus, the above ape languages demonstrate interchangeability . Nevertheless, there are other Hockett language features that need to be tested, such as how is language transferred from generation to generation.

The language tradition design states that "the conventions of a language are passed down by teaching and learning which indicates that they are not inherited"(Hockett 1960). Many critics of ape language argue that, if linguistic skills are instilled in captivity, then they are bound to be an artifact of training, and as a result will reveal little about the "true" cognitive capacities of apes. Nonetheless, apes in the wild do not communicatively express themselves through a sophisticated visual language level, a point which cynics use to deny the existence of ape language. Ironically, these cynics ignore the fact that man similarly requires training in order to communicate. Man and ape infants left in their natural states do not learn how to communicate effectively through either verbal or non-verbal means. Left alone, these infants would at best establish some sort of rudimentary verbal/nonverbal communication system. Thus, it is illogical to discriminate against the apes' linguistic skills on the grounds that they are acquired in human captivity rather than in their natural world since man also requires instruction. Language, therefore is a social construction. Furthermore, a developmentary

level of linguistic skills found within domestically trained apes such as Washoe, Koko, Sarah, and Lana note that this design is not solely a human characteristic.

The next language design of *learnability* is related to traditional transmission in that normal intelligent children or adults are capable of learning a second language after acquiring a first language. Metaphorically speaking, the domestically trained great ape signers inherently possess a natural and/or oral language that became superseded by their newly learned visual language. The above replacement however represents an advancement from an acquired ape language to a learned human language. Nevertheless, Sarah learned two languages; initially she attained proficiency in chip symbology while later, she demonstrated linguistic competence on the lexigram machine.

The apes satisfactory fulfillment of these previously stated language characteristics necessitates that we conduct an independent analysis of each candidate's linguistic competence. The apes' human instructors utilized different instructional methods to teach their apes' three distinct visual languages. Nonetheless, they yielded many similar results but in diverse forms. Which ape then became the first to cross this human language barrier. Washoe became the first primate to leap this hurdle, and she also became the first ape to communicate through Ameslan. Her initial instructors were R. Allen Gardner and Beatrice Gardner, Allen is a verbal language specialist while his wife Beatrice is an ethologist.

## *WASHOE AND AMESLAN*

After concluding that chimps were not capable of producing human sounds, the Gardners began teaching Washoe sign language in 1966. To be specific, they adopted this stance after analyzing Keith and Catharine Hayes attempt to teach a spoken language to a chimp named Viki, who only managed to roughly produce the words- "cup" "mamma", "up", and "about" (which the Gardners (1976) presented during their film entitled, "First Signs of Washoe"). They noticed that Viki's oral productions were accompanied by characteristic gestures and thus concluded that a gestural language might provide a better medium of communication.

They decided on Ameslan since it was popular, analyzable, and would provide a basis for comparing the performances of deaf and normal speaking children. "All signing, whether with Washoe or between investigators was conducted solely through ASL, speech was not allowed"(Fobes and King 1982:365). In this film, the Gardners(1976) state "apes generally follow the human cognitive stages of a child, so they created a similar child-like environment to enhance the development of these verbal skills." She was primarily taught in a typically furnished house and allowed to roam in the nearby yard. The Gardener's; however, were not Washoe's sole instructors, they were later joined by Dr. Roger Fouts in 1971, who subsequently brought her to the Institute for Primate studies which is located in the University of Oklahoma(Linden 1974:5).

The next hurdle involved teaching Washoe Ameslan, they utilized an instructional method called "moulding" which involves an instructor who grasps the subject's hands and forms them into the proper sign's shape while a child or chimp looks at its signifying representative. Washoe, consequently learned signs through imitation or through the progressive "shaping" of her gestures; both of which provided instructional opportunities for the Gardners (Linden 1974:5). Washoe was rewarded for each correctly produced sign(s) which eventually amounted into a progressive vocabulary. She was trained in ASL from the age of 1 until she was 5 (Fobes and King 1981). After 22 months of training, Washoe had acquired over 30 signs that she used spontaneously and appropriately. By the age of three, Washoe, was able to reliably utilize 85 signs singularly and in combinations. Later, she accumulated "132" signs asked "questions" and used the negative (Linden 1986:219).

**KOKO**

The Gardners' work with Washoe later yielded similar results found in the gorilla, Koko, who also showed a high degree of competence in ASL. It was in the 1970's that psychologist Penny Patterson became interested in the Gardners work with Washoe and thus developed project Koko. Patterson (1976) acquired Koko from the San Francisco Zoo and began to instruct her, and later added a male gorilla named Michael, to her studies both of which were specifically instructed through the sin-com method which involved verbal and nonverbal instruction. As a result, "both gorillas learned to Utilize ASL and comprehend some spoken English"(Patterson 1986:2). Washoe and Koko's ability to formulate a human language

in the form of ASL is evident in analysis comparing their skills to those of an ASL signer. Yet, before we undertake this comparative task we must note the difficulty in translating from human oral language to ASL to gorilla sign language.

**SIGN LANGUAGE.** These translations encompass more than associating English words with signs. First of all, "sign language is a visual manual-language instead of an auditory-spoken one, and as such relies on movement and space to communicatively express spoken words"(Patterson 1986:4). Again, sign language primarily relies on producing hand gestures in front of the body which are viewed by the signer and signee. Thus, the sign is determined by four parameters: handshape, location, movement, and palm orientation(Linda Remmel, Personal Communication 1987). A change in any one of these features may alter the sign's meaning. Nevertheless, facial expressions(such as mouth movements) and body position are also significant in formulating signals that carry linguistic data. These non-sign aspects were first referred to as non-manual signals in the 1888, publication, The Life of Thomas Hopkin's Gallaudet(Liddell 1980:1). According to Liddell(1980:3), non-manual signals are used as markers forming yes-no questions, Head shake negation, lip reading and topicalization. The yes-no questions is expressed when the face and body are forward and the brows are raised during the entire request- as in Liddell's example of "woman forget purse?"(1980:3) (See Figure 1).

According to Fischer(1972), "headshake negation consists of a side-to-side head shake accompanied by a non-neutral [subjective] facial expression while the affirmative is formed by tilting the head vertically up and down" (Liddell 1980:3).

Topicalization is formed when a sentence has an "intonation break between the topicalized constituent and the rest of the sentence, accompanied by pauses, head tilts, raising of the eyebrows, and probably numerous other cues"(Liddell 1980:4). All three of these non-manual signals along with lip reading will not be examined-since to my knowledge-they have not been utilized in ape language instructional techniques. Sign languages also do not utilize the articles (a, the, etc.), the verb to be, or a number of other fragments of speech found in spoken English (Ibid). In two other examples: Patterson (1986:4) states "a child might sign " poor no cry" to express "they were poor" and couldn't have anything and she cried, or an adult could sign "shop me" to mean "I am going shopping." ASL also doesn't utilize the plural markers, and suffixes like "ed' and "ing" since no signs exist in ASL for these English morphemes. Liddell(1980) notes the above present participle (ing) feature in the sentence "cat sleep on fence"(V). In signed English, this translates as "the cat is sleeping on the/a fence(ibid). Similarly, the past tense in the English sentence "the cat slept on the fence" is formulated -in ASL-as "cat sleep on the fence"(ibid).

A concept in ASL may require only one sign whereas English usually requires several words. Secondly, modifications in the hand movements of some single signs indicates distinct connotations. For instance, the sign give denotes you-give-to-me; I-give-to-you; he-

gives-to-them, and 12 other meanings. ASL, thus lacks human oral language's article, past tense marker, present participle, plural indicator, and its verbal-auditory emphasis. ASL, instead relies upon distinct palm orientations, facial gestures, body position, and specific hand movements to formulate language. Nevertheless, ASL's non-manual signals will not be utilized as criteria during this comparative analysis. Whether or not these remaining semantically distinguishable subtleties are accurately followed by the ape is left up to interpretation. However, the ape's differing hand, head, and body shape, should be taken into account before judgment. I however, am not a functional user of ASL and as such may only novicely comment on their ability to sign effectively.

Nevertheless, I can present descriptions of these ASL signs and compare them with primatologists who have provided photos of their subjects in their texts. This comparison necessitates a visual chart of the various hand shapes used in creating these sign words. I have provided a description of these hand shapes in Figure 1 of Bornstein and Saulnier (1986:xx). In a June of 1987 "Gorilla Journal photo Michael, is depicted signing good, which is made by "opening (B) both hands (letters refers to hand shape) palms in tips slanted up, then placing right tips on mouth and moving out and down, placing back of hand in left palm"(Bornstein and Saulnier 1986:126). Michael inflectively makes this sign by placing both of his open hand tips against his mouth, he obviously isn't able to place his right hand tips out and down upon his left palm. Michael, may be creating this alternate sign version since he lacks the necessary human

coordination. Thus, Michael is at least capable of partially signing "good" accurately.

The next example shows Koko signing "mail" which is signed by placing "the thumb of the right (A) on the mouth, changing to (M) shape and then placing on the tips in an upturned left palm"(Patterson 1986:12). Koko similarly positions her right thumb A into her tongue tip(Bornstein and Saulnier 1986:23). Whether or not she continues the remaining sequence is not known since she is pictured only once and the full sequence would entail at least two photos. Again, based on this photo, Koko, like Michael, correctly displays part of the sign's sequence.

In a third example, Koko signs "toothbrush," which is depicted by rubbing the edge of the right index finger back and forth over the teeth"(Bornstein and Saulnier 1986:19). Koko is displayed rubbing the edge of her right index finger similarly back and forth over her teeth (Patterson 1986:157). There is no doubt of her competence here.

In the last illustration, Koko signs "ask" which is indicated when" the palms are placed together with the tips out and then by raising them, so that the tips end up"(Bornstein and Saulnier 1986:40). Koko follows this routine almost perfectly, except that her fingers are slightly mis-aligned. Based on the above examples, Koko and Michael's signs appear to be approximations of the signs descriptions. Nonetheless, more substantial ape ASL is evident in Washoe and Koko's word order formation.

ASL authorities do not commonly agree on what is appropriate word order, yet, the SVO order is generally acknowledged as acceptable. A grammatical order lacking these three features is more likely to be criticized. For example, an individual sign such as "home"(O), lacks a subject and verb yet, they may be implied as an answer to the following question: where is John?, the reply "home" could signify John is home. Furthermore, the sentence " I will (S,V) would suffice as a reply too the question, Will you play the guitar? In this case, the object "guitar" would be inferred. Nevertheless, most critics would only accept a complete SVO order as appropriate linguistic testimony.

As an ASL authority, Fischer (1975) proposes that a sentence such as "Dog chase cat" structurally applies to each of these SVO orders (in Liddell 1980:71):

"Dog chase cat " :SVO, this is the underlying order.

"Cat, dog chase ":O,SV Topicalized object.

"Chase cat dog ":VO,S Topicalized verb phrase or postponed subject.

"Dog cat chase ": SOV Non-reversible subject and object or grammatical relations shown by the direction or orientation of the verb.

"Cat dog chase "OVS Non reversible subject and object (controversial).

When these orders are applied too various signed ape sentences, they may determine the legitimacy of ape syntax. Unfortunately, the intonation feature (topicalization) is difficult to notice and I will not be able to present them through the only means at my disposal--

photos of ape ASL sentences. I state this with regard to the lack of ASL ape photo sequences that correspond to each individual sign within the sentence. The majority of the apes' signs appear as single photos in my research literature which is insufficient since a sequence of signs are necessary for portraying these intonations. For instance, the topicalized head tilt or eye brow raise would need to occur from one photo(sign) to the next photo (sign).

In 1971, Washoe produced Fischer's numerous subject-verb-object word orders. They include (1)"gimme sweet"(VSO); "Roger tickle"(SVO); (3) "You me go out hurry"(SVO) and "you tickle me"(SVO)(Linden 1974:42-45). The first example, can be understood as give me a sweet (VSO) with gimme acting as a verb and subject. The second example, infers the subject in Washoe's request while the third sentence's word order lacks a copula to join the subject which is not utilized in ASL. The last example, clearly follows the SVO word order.

These 2-5 length word orders developed during Washoe's ASL acquisition stages. The Gardners demonstrated Washoe's two year old language proficiency level through a comparison of her skills with that of, "Roger Brown's description of language and development in the infant"(Linden 1974:35). In 1962, psycho linguists Brown, Bellugi, and Fraser divided a child's linguistic development into five levels (Linden 1974:36). Brown (1973) believes that "each child progresses through these stages at its own rate but that the form of changes that take place are constant across children throughout the U.S. (Fobes and King 1982:365). His main measurement technique was the (MLU) or "mean length utterance"

which according to Fobes and King (1982) is more reliable than chronological age in predicting a child's linguistic level. They note that a child says his first word after approximately six months and then begins uttering two word sentences at around 18 months(Linden 1974). The one-two word proficiency corresponds with level one which consistently averages 1.75 morphemes until the age of two. A level 1 child often produces what Brown(1962) calls telegraphic essentials which typically consists of short phrases such as "mommy lunch"(ibid).

Brown's(1962) method noted that "specific relationships are to some extent independent of the specified words that form the phrase which implies that sentences are characterized by structure (in Linden 1974:44). Brown (1962) placed 75% of a child's combinations into this scheme while the Gardners(1971) applied 78% of Washoe's-294 two-sign combinations into the same classification (in Linden 1974). The Gardners(1971) concluded that "Washoe demonstrated level one proficiency" (ibid).

The Gardners(1971) were able to apply Washoe's two word combinations with Brown's through the development of two classes; pivots and a larger class of words with which these pivots were combined. Pivots are the small number of words used most frequently in two word combinations; Washoe's include "gimme please", "you", and "go"(Linden 1974:40). The Gardners then categorized Washoe's vocabulary in order to see if there were inherent "special privileges" within specific signs(Linden 1974:42). The categories were then compared with Brown's scheme for children. This involved distributing Washoe's two word signs into six

categories (see Figure 2). The majority of Washoe's combined signs fell into the "appeals", "locations", and actions" categories. This was exemplified in the word "gimme" which is relevant to more situations than a word like "banana" and thus would be more applicable to other categories of combined words. The Gardners(1971) believed that these "two words" express a relationship where one could not ; which suggests that these signs serve certain "constructive" functions(Linden 1974:40).

When a two word combination denotes both the meaning and a general relationship between two words it is known as a construction (Linden 1974:41). For example, "dog bite" is a construction since the words dog and bite have a special subject and verb relationship. Brown(1970) originally believed that this feature was practiced exclusively by man; yet, Washoe similarly demonstrated this feature during the following conversation: "Washoe: Please; Person: What you want?; Washoe: out ; Person: What you want? ; Washoe: Open; Washoe: More; Person: More what? ; Washoe: tickle ; Washoe: you ; Person: I what? ; Washoe: You more drink" (Linden 1974:41). The Gardners were able to note the two word combinations "More tickle" or "Please out" often omitting the person in this dialogue(Linden 1974:41). These constructions were evident when Washoe said things to prompt her instructor to ask a question which allowed Washoe to reply and complete her previous statement.

Brown's(1970) construction feature parallels Hockett's semanticity design. This design feature entails associating elements with their messages. In other words, the subject needs to demonstrate comprehension of the meaning within the concept or item itself.

Washoe demonstrated this design when she applied the open sign to various closed items without initial prompting. They include: suitcases, doors, boxes, etc. Washoe was thus able to successfully apply the meaning of openness to several contextually relevant situations. Other semantic evidence occurred when Washoe signed "there" or "go there" after being asked "where?"(Linden 1974:41). These combinations correspond with Brown's (1970) stage II range which has an MLU that varies from 2.0 to 2.5. In this stage a child acquires grammatical morphemes which when utilized with other words form a basic structural meaning(syntax)(Fobes and King 1982:65).

Washoe next increased her combinations of two words into larger combinations. Approximately half of these consisted of adding a "please" sign to a two-word combination such as "Roger Tickle" (Linden 1974:45). The other half comprised additional information which included additional agents (you me go out); name-pronoun redundancy (you tickle me Washoe); extensions of two word constructions (you me look out) ; apologies (hug me good); which possessed action, agent, attribute, and finally phrases that specified both subject and object, such as you "tickle me"(Linden 1974:45). These larger amalgamations match Brown's(1970) level III which ranges in MLU from 2.5 to 3.0. This stage is further identified by the addition of certain words and/or change in word order to change a simple declarative or affirmative sentence into an interrogative, an imperative, or negative(Fobes and King 1982:365).

Washoe was also able to partially fulfill Brown's(1973) level IV stage which contains an MLU of 3.0-3.75, that occurs when a child embeds one sentence within another"(ibid). She created the appropriate MLU level but I found no data supporting her imbedded capability. Fortunately, I did find a sentence that fulfilled level V which ranges in MLU from 3.75 +, and involves creating two sentences into one through the use of connectors such as and, but, etc. The conjunctions; however, do not exist in ASL but they may be implied in the following Washoe sentence "You _?_ me go out"(Linden 1974:45).

Brown(1970) believes that the rudiments of syntax develop when three word utterances such as "You tickle me" begin to appear(Linden 1974:45). The child's deliberate selection of specific word order is another prerequisite of syntax development. Washoe similarly demonstrated certain word order preference during her shift from placing both the subject and object in front of the verb "You me out" to putting the verb between the subject and object "You tickle me"(ibid). Washoe placed the subject before the verb 90% of the time which indicated non-random responses (ibid). Washoe's ability to produce a grammatically correct order in sync with Brown's(1970), language acquisition stages further demonstrates evidence of an ape language.

Washoe also fulfilled Hockett's(1960) productivity design. In 1973, Roger Fouts and a colleague named Roger Mellegren discovered that Washoe was able to use reliable signs to describe novel objects for which she had no words within her vocabulary of signs. This discovery satisfies Hockett's productivity feature. For instance, when

presented with a new object, Washoe occasionally described it by creating new meaningful combinations of signs, She signed swan for "waterbird" since she did not yet possess the sign for swan(ibid). She also indicated productivity through the use of swearing. She referred to her "leash as "dirty leash" because she often became incensed during its presence (Linden 1974:113). The creation of these newly descriptive signs indicated that Washoe does indeed produce newly relevant hand signals in a coherent fashion. Washoe, thus is able to grasp one of her many vocabulary signs and adequately describe a newly presented item - the swan(Linden 1974:46).

During the film "Teaching sign language to a chimp, "Washoe demonstrated displacement when she signed "out" toward the door of the house as a request to leave the premises (1974). She also signed "open" while in the box that enclosed her. The formulation of the signs into a contextually displaced temporal location indicates Washoe's displacement capability.

In summation, the Gardners(1970) believe that Washoe acquired Brown's 1-3 levels, an assertion that Brown(1973) originally denied, yet later recanted admitting that she may satisfy at least level 1(Fobes and King 1982:365). Furthermore, Brown(1970) may have conducted too early of an analysis since the Gardners continued to instruct Washoe, for another 15 months. I posit that Washoe clearly fulfills Brown's first and second levels and all five of his MLU stages. She also displayed the constructive feature(semanticity) in the previous dialogue responses of "please out" and "more tickle" which indicated that she understands her expressed signs(Linden

1974:41). She also demonstrated Hockett's open design by referring to the unknown word for swan as "water bird" and competence in displacement when she signed "out" toward a door while inside (Linden 1974:113). Washoe's word order accuracy percentage attests to her development of a rudimentary grammar which parallels the competence of a 2-3 year old human. Washoe also fulfilled Fromkin and Rodman's(1983) linguistic hierarchical relationship of the phoneme (phereme), morpheme (chereme), syntax, and grammar, and Hockett's remaining designs during a comparative analysis between ASL and human language.

### *KOKO AND AMESLAN*

The next ASL primate to demonstrate similar linguistic competence was Koko, the gorilla. Koko, like Washoe, showed a developmentary word order process that met Fischer's (1977) criteria. They are featured in the following word orders "Tickle me Penny" (VOS); "More cereal me eat"(OSV); "Drink orange Koko thirsty drink"(VSO); and "Please hurry on necklace"(S?VO) (Patterson & Linden 1981:86). Again, the inflection feature is not noted (as a comma), since there are written examples. The last example, infers the existence of the subject in the request "Please" word ; whether or not this meets ASL word order criteria-is another matter. The verb-subject-object word order is also controversial since the above examples have reversed the subject and verb positions. The remaining examples clearly meet ASL's appropriate verb order ; in fact, the second example possesses adverbs and adjectives which possible notes a competency in descriptive use as well.

The next study revealed that ape language legitimacy is currently evident in a comparative analysis between the linguistic stages of the gorillas Koko and Michael with that of John Dore's (1973) research on the early language development in young children. The development of ape rudimentary language appears in the simultaneous communication (sin-com) method which gorillas Michael and Koko were subsequently exposed to. Both of these approaches concentrate on the early language development among young children and captive apes. In the December, 1986 issue of the Gorilla, the journal of the gorilla foundation, Patterson (1986) et al. adopted a pragmatic approach towards Koko and her early utterances (2). This pragmatic analysis focuses on the intent of the speaker rather that on the syntax; nevertheless, we may apply Fischer's word order to Koko's sentences. Pragmatism involves looking at what the speaker is trying to accomplish; examples include questioning, demanding, and observing. Patterson classifies Koko's early communicative skills with Dore's child utterance categories which consist of labeling, repeating, answering, requesting action, requesting an answer, calling, greeting, protesting, and practicing.

Patterson (1986) began recording data during Koko's first month on the project, when Koko was one year old. This period occurred from July, 1972 through Mid-June, 1973 and was analyzed to ascertain the frequency of her use of Dore's stages as she acquired sign language. According to Patterson (1986), Koko completed all of Dore's stages within three months of training.

Koko's first month involved protests which corresponded to the infant behaviors of hitting, biting, and running away. She, like children, protested and demanded attention through her whining, crying, and screaming when left alone or ignored. Her protest resembled an annoying bark which Dore (1973) found comparable to that of a child who (after failing to push a peg through a hole) utters "uh-uh"(Patterson 1986:2). Koko showed great potential for sign language during her first day of instruction. She duplicated Penny's "Hi" sign which involved placing the hand to the head and tapping it (ibid). By the thirteenth day, Koko had successfully made gestures similar in form to the food and drink signs (ibid). On the 29th day, Koko utilized the food and drink signs accurately during many different situations, as when viewing her cereal-milk bottle which indicated her labeling and request action skills (2). She also spontaneously signed "food" when a volunteer brought food, and during a volunteer's clean-up of her remaining food (7). She also presented the sign accurately during the items presence which indicates that she successfully associated the sign with the food.

This association is otherwise known as labeling or semanticity. The pragmatic approach in of itself complements the semanticity design which seeks to understand how linguistic signals are associated with features in the physical, social, and cultural world of speakers. In short, the pragmatic approach emphasizes the function or intention of the message which similarly corresponds to semanticity's denotative element. Nevertheless, this feature consistently occurred during Koko's 3rd month. This semantic consistency likewise corresponds with Dore's (1973) level 1 and 2 stages.

During the first month of study, Koko fulfilled every pragmatic classification with the exception of answering questions and requesting questions (Patterson 1986:3). In this month, Koko also over-generalized words as 3-4 year old children similarly do. For instance, she signed food and drink for a number of requests; such as shoes, toothbrushes, bells, and companionship. This action is also known as "generalization" which occurs when children place large classes of words and sounds into smaller classes (Lenneberg 1967:274). During this period, she also continued to create signs or vocalizations along with non-linguistic behaviors. Perhaps the most revealing aspect of this stage was Koko's ability to babble. This feature was once established as a trait distinguishing human infant behavior from that of a chimp. The ape is of course vocally incapable of producing an oral babble yet the existence of a visually signed one is just as acceptable. Koko demonstrated this trait at night while babbling "manually" and during the day when she practiced signing alone (Patterson 1986:3).

During Koko's second month, she consistently began forming accurate signs. These signs were used in a meaningful context during conversations; this is otherwise known as semantics. This ability occurred during one of Koko's favorite games in which Penny blew on a window to form fog so they could draw on it. Koko, displayed her intentions to play the game by signing "There toward the window" (Patterson 1986:3). Penny, then, carried her to the window and Koko pointed to her mouth and then touched Penny's "mouth" (which is equivalent to mouth-you, and is created by signing on another's mouth) and finally pointed "There" toward the window

again (ibid). More importantly, Koko signed the sequence twice and ended with what is known as a question modulation which involves "seeking and holding eye contact with the final sign"(Patterson 1986:3). Other examples occurred when Koko, signed "blow" after hearing the wind blow outside her room and also when she applied the sign "listen" to various sounds such as to the ticking of a watch, a bird chirping and to bell (ibid).

Koko also requested answers during the second month of training. In one example, she initiated a request answer by displaying her to be molded into signs and by bringing her nearby instructor's hands together. For instance, Koko signed "food" for a bottle, and when the bottle was not presented , she resigned "food"(Patterson 1986). When the bottle was withheld again, she grabbed her instructor's hands toward herself for molding rather than placing them on the bottle. Koko's request was for food, her signing and her actions inquisitively requested her trainer to explain why she was being deprived of food after signing the item correctly; nonetheless, she may also have grabbed her instructor's hand to request the right answer, thereby, gaining, the appropriate sign for her desired milk. Her true intentions are of course left up to interpretation; nonetheless, they do seem to imply one or both of the above connotations that are based on the context of the situation.

During the third month, Koko began to respond with signs after answers were requested. In one example, Koko viewed her juice mug and signed "food". Patterson(1986), then replied "no", "What's that?" and Koko, immediately signed "drink"(4). Koko's ability to answer correctly proves she understood her mistake by rectifying it.

More importantly, she was able to think back in her memory storage and accurately pull out the sign "drink" (the function of the mug) to describe the cup's contents. She was thus able to meaningfully associate the sign "drink" with its physical representative-the mug, which corresponds with Hockett's(1960) semanticity design.

In the fourth month, Koko often signed "out" when she wished to be transferred elsewhere. She created a variety of uses for the sign over time that were likewise utilized in appropriate context. For instance, Koko continually signed "out" when Patterson (1986:4) arrived (a request action) to the trailer. In another incident, she signed "out" and picked up her sweater and handed it to Penny, who put it on and asked her what she wanted again; in response, Koko signed "out" and pounded her wrist with her fist affirmatively, a sequence that follows Dore's (1973) Answering, Request Action Stage (ibid). In another example, Koko signed "out" before jumping off a piece of furniture. Koko's "out" requests like Washoe's fulfills Hockett's (1960), displacement design which occurs when someone mention things that are remote in time and space. "Out" is remote in time, in that it refers to another area-outside and to a future time, both of which denote displacement from the here and now. Koko also exhibited this design when she signed "home" while a passenger in a car bound for the Patterson's home(1985:5). Further evidence of Koko's comprehensive skills appear during conversations. For instance, Koko obeyed Patterson's (1986:4) command of "give me" by handing her a pen she had just stolen.

Koko similarly demonstrated Hockett's(1960) *productivity* design by referring to her body parts in a personal way. This occurred when, Koko became extremely bored of naming body parts and expressively signed "think eye ear eye nose boring "(Linden 1986:2). This sentence implies her ability to blend signs creatively into new sentences that describe her very opinion toward this drill.

In conclusion, Koko in contrast to Washoe, fulfilled all of her child developmentary linguistic stages. She achieved competence in all of Dore's(1974) prescribed language levels within four months, a feat that was originally considered highly unlikely. This proficiency like a child's progressed over a period of time a fact which acknowledges her true attainment of these linguistic skills. Koko also generated the unique linguistic features of generalization and babbling. In addition, Koko like Washoe, demonstrated competence in all of Hockett's(1960) designs with the exception of prevarication and the vocal auditory channel.

Dore's(1960) analysis revealed Koko's adeptness in the designs of semanticity, productivity, displacement, and duality of pattern. The remaining designs of arbitrariness, interchangeability, broadcast transmission and directional reception, specialization, discreteness, traditional transmission, total feedback, reflexiveness, and learnability during the comparative analysis between human language and ASL. Koko, like Washoe, similarly fulfilled Fromkin and Rodman's(1983) hierarchical language elements of the phoneme, morpheme, syntax, and grammar. The parallels found between these apes and the early linguistic stages of children was also attributable to the human environment they were raised in. Washoe learned

much of her language within the Gardners home and later was transferred to the Institute of Primate Studies while under the care of their colleague Dan Fouts, while Koko, was first instructed in a trailer on the Stanford campus and then removed to the Pattersons' home for a total of 11 years to date. Koko's advancement beyond Washoe's ASL proficiency is probably a result of her longer training.

Critics of Washoe and Koko

Although Washoe and Koko demonstrated proficiency in these linguistic features, their instructors work became strongly scrutinized by many different scientific fields. In particular, the Dahlem conference participants (a group that discusses contemporary thinking in "communicating as evidence of thinking) proposed several criticisms of primate language (Linden 1986). They contend that Washoe lacks language since she repeats phrases only immediately after her instructor and also rarely led a conversation. These assertions are based on the conference spokesman Herb Terrace's work with his Ameslan trained chimp-Nim and his critique of the film "Teaching sign language to the chimpanzee: Washoe"(1974). He purchased Nim in 1973, from the Institute of Primate Studies, Nim, at this time possessed a vocabulary of about a dozen words (Linden 1986:64). He originally began instructing Nim, through the behaviorist approach which yielded few results so he turned to Roger Fouts methods (ibid). In his study, he began filming the interactions between the apes and their trainers and analyzed three and a half hours of a graduate student's videotapes and concluded "Nim's statements were most often repetitions of words his instructors just made; he rarely seemed to take the lead in

initiating a conversation, and always required awards to reply appropriately (Linden 1986:64). Furthermore, Nim interrupted a great deal and did not seem to understand the interactive nature of conversation (Linden 1974:64).

Many of these claims have since been denied through careful examination of Washoe's and other trained ASL apes. The notion that chimps are capable of signing only immediately after their trainer implies that they lack memory retention. This traditionally held ape deficiency was discredited during an incident that isolated Ameslan chimps from instruction. This occurred when the founder of the Institute for Primate Studies, William Lemmon(1974), shipped his aging chimps to the laboratory of Experimentational Medicine and Surgery as a solution to their potential danger as adults. Several months later visiting primatologists Sullivan, MacIvor, and Linden became startled when chimps Ally, Nim, and Jezzabell responded to their signs. These results were received without rewarding the chimps responses. When Sullivan asked caged Ally, what he desired, he replied, "key", Chris, then presented a watch, glasses, and a shoe which Ally, descriptively signed appropriately (Linden 1986:144). The next chimp, Jezzie, produced "food", "drink", and "key" when asked the same question (ibid). Lemmon remarked that it had been years since the chimps had any real exposure to sign language (ibid). These examples indicate the chimps' ability to retain their memory for a prolonged period of time without instruction. Thus, we may postulate that these signs became part of their lifestyle. Moreover, their unrewarded responses further disproves Terrace's(1974)

stipulation that chimps repeatedly require an immediate reward in order to respond.

Terrace(1974) sought further evidence to support his claims by analyzing data from Washoe, Koko, and many other visual language-using apes. Terrace(1974) relied on his analysis of the Gardners film "Teaching Sign Language to the Chimpanzee: Washoe"(1974). Nevertheless, Terrace(1974) examined only thirty five seconds of the film's 39 minutes since this was the only unedited portion displaying any interaction which he felt would not be able to hide any curing that might have occurred during edited portions. However, the Gardners(1976) state that their film was designed to only show Washoe's vocabulary rather than the syntax features which Terrace utilized in his analysis"(Linden 1986:4). Terrace(1974), next claimed that "this brief film piece shows Washoe, interrupting Beatrice Gardener, three out of four times when Dr. Gardner began to create a sign"(Linden 1986:65). Terrace's conclusions have been disputed by many proponents of ape language.

Psychologists Roger Fouts(1975), Chris O' Sullivan et al. (1975) analyzed this same film portion and counter-concluded that in fact it was "Beatrice Gardner who interrupted Washoe twice and gave her the wrong behavioral signals another time"(Linden 1986:65). They also analyzed Terrace's method which relied on his analysis of the individual frames which displayed each sign more clearly. These psychologists state that this approach was unreliable since it is not possible to analyze an "interruption" the way one would if the interruption occurred in spoken language"(ibid). For instance, they noted that "simultaneous signing is comprehensible by both

participants"(ibid). They concluded that " the rates of interruption must be determined by such variables as eye contact, hand position, body orientation, signing motion, and content"(ibid). Thus, isolated frames are probably incapable of discerning the interplay of hands, eyes, body orientation, or sign continuity. Furthermore, Carolyn Ristau and Donald Robin's analytical survey of all the different language experiments revealed that the "methods of data collection and analysis to date do not let us determine the limits of the ape's ability nor do they much help us to understand the meaning inherent in the ape's linguistic productions"(Linden 1986:68). They concluded that ". . . apes may be more proficient than Terrace suggests, the data do not at all dismiss that alternative"(Linden 1986:68).

Indeed, Terrace's work and actions manifest many intrinsic contradictions. Firstly, Herb Terrace(1986) later admitted that Nim's performance might have been the result of a problem in experimental design rather than his lack of capabilities"(Linden 1986:71). This is quite apparent given the fact that Terrace is known to have hired sixty different instructors to teach Nim during the projects four year period"(Greene 1987; personal communication). Nim, also experienced numerous environmental changes which when coupled with the changing instructors probably influenced Terrace's data and as a result indicated the ape's linguistic deficiencies. Koko and Washoe's greater linguistic skills are probably attributable to fewer instructor and environmental alterations. For instance, Koko was taught by Penny Patterson while Washoe received instruction from the Gardners and later Dan Fouts. Koko's environments include: the San Francisco Zoo (her first residence), a trailer on the Stanford

campus, and final residence with the Patterson's themselves. Washoe initially resided with the Gardners and then, later lived at the Primate Institute under the care of Roger Fouts.

The temporal element has also played a part in Nim's weak linguistic performance. Nim's four years of interrupted training is countered by Koko's eleven years of continuously uninterrupted progress. Washoe was instructed by the Gardners from 1967 until 1971, the year Fouts brought her to the Institute for Primate Studies, for an additional four years of study. Thus, Nim's shortcomings are probably due to his constantly changing environment, numerous instructors, and inadequate study length. The flaws in Terrace's approach do not in themselves support the legitimacy of an ape language but they do hint at what guidelines should be followed in order to attain better results. For instance, one of the best indicators of ape linguistic proficiency is found in the double blind fold test.

This testing involves the person or animal to be tested and three testers. The test prevents the person presenting the stimulus and the two persons recording the answers from viewing what the person or animal being tested is responding too. Most importantly, it prevents the instructor from cueing the ape. The procedure is as follows: the ape is seated in front of a cabinet sliding door. An individual who is unable to visualize the ape, would flash randomly arranged slides onto a screen in front of the ape when she opened the sliding door. Another experimenter, who could not see the person flashing the slide would ask the subject in sign language what she saw and record Washoe's response. The third trainer, stood in a room next to the first person's room and also recorded the apes

responses. Both observers data were compared to derive an accurate conclusion. The second observer represented a control which established the accuracy of the initial observer's recording of Washoe's responses(Linden 1986:19). The Gardners film "First signs of Washoe" (1976) demonstrated that Washoe accurately signed 90% of the time while undergoing this test.

***Sarah and the Chip Symbology Language***

The next ape to demonstrate linguistic competence was Sarah. In contrast to the ASL approach, her trainer Premack(1970), used a variety of plastic chips to instruct his most notable chimpanzee subject, Sarah, who began training at the age of six. Premack trained Sarah in a "discrete-trial" problem solving format rather than in a socio-interactional communicative context" as was adhered to during the ape ASL projects"(Rumbaugh et al. 1982 in Fobes and king 1982:368). This method required only a small vocabulary of "names" for agents, objects, and action which were taught by pairing the plastic chips with their referents"(Fobes and King 1982:368). Premack developed both a "nonverbal" and "verbal" interrogative for the chimpanzee(7). The verbal interrogation, "involved arranging a simple state of affairs such as placing a red card on a green one, and then asking the chimpanzee "red on green?"(is red on green?). The chimpanzee proved just as capable of answering this question through the filling in of blanks during a non verbal test (ibid).

Sarah was also trained on some basic syntactic rules. For example, she was required to fill in each slot(one per trial) in a string such as "Mary give apple Sarah," from two or three alternatives(Fobes and King 1982:368). She was also trained to respond appropriately to

such strings. Premack(1976) states that language is a product imbedded within intelligence and mechanisms may be utilized to understand its features. These mechanisms include; causal inference, intentionality, representational capacity, memory, and second order relations. Underlying these mechanisms are Premack's(1976) exemplars of language- "the things an organism must do in order to give evidence of possessing language"(Linden 1974:173). These exemplars are the language design features that Premack describes as a list of topics which include: "words, sentences, the interrogative, the conditional, negation, the metalinguistic, and dimensional concepts like color, shape, and size"(Linden 1974:173).

Sarah's first exemplar was the word. She was taught to associated plastic word symbols with their objects through the "homespun-routine". For instance, one example, revolved around Sarah's consumption of milk. The method is as follows: one trainer brings a bottle of milk; displaying it high to assure Sarah visual attention, then a second trainer makes the request "give milk"(Premack 1976:53). The first one replied "give what?" pretending not to have noticed the two plastic words his companion handed him. "Milk" was the next reply and the instruction closed to give Sarah time to make the connection between the symbol and its object. Sarah, was then given the chips and a trainer expected her to reply "give milk?" after presenting the milk bottle before her(ibid). If Sarah correctly replied, then it was assumed that she now understood the symbol for milk. The process was then applied to new words until Sarah could no longer make the association(Premack 1976:53).

Initially, Sarah was rewarded for every correct response, yet after consistent accuracy she no longer required a tidbit for a previously learned word. This routine was further utilized to enlarge Sarah's vocabulary. Sarah was later taught to learn words more rapidly through the association of a symbolic shape with that of an introduced item (the referent). This was generated by the metalinguistic form: x is the name of y; in this arrangement x is an unused piece of plastic(symbol) and y an unnamed object. He taught her new words by placing "name of" between a token and its object(the referent). The symbols shape (x) becomes a word when it independently represents the referent (y) which it was originally associated with. This is evident through Premack's(1970:168) "match to sample test" which independently analyzes both the word and its referent. In the first verbal test, Sarah was presented with an actual apple(referent) as a sample and with pairs of alternatives that did and did not describe some feature of the apple(Premack 1976:168). Four pairs of alternatives were used during this initial test: a red plaque versus a green plaque, a square with a stem like protuberance versus a plain square, a plain square versus a circle, and a square with a stem like protuberance versus a square(see Figure 3; Premack 1976:170). The test was designed to determine whether chimps "can identify an object through its features". Sarah's accuracy corresponded appropriately with that of a normal child. For instance, She chose red over green, round over square, square with a stem like protuberance over plain square, and usually round over a square with a stem(ibid).

Sarah's ability to associate the apple with its characteristics satisfies naming which only involves visually associating an uniconographic symbol with that of a physical item or abstract concept. However, naming alone, does not demonstrate the apes ability to recognize the inherent meaning behind the presented symbol. True semanticity is evident when an ape forms a word or sentence without the presence of the identifying object. Thus, the test was repeated again with the replacement of the object apple with that of the word for apple. The word apple (x) was represented by a small blue triangular piece of plastic; this arbitrary symbol is of course blue unlike the color of a red apple. Its shape, is not circular, both of which indicate that it is a legitimate arbitrary symbol. With this in mind, she was still able to assign red over green, round over square, and so on which demonstrates her ability to successfully associate the referent with its characteristics thus indicating that she understands the objects underlying visual features.

Valid comprehension followed when she managed to associate the referent with its arbitrary symbol and still correctly relate the former's characteristics with that of the latter's. This feature complies with Premack's second order relations mechanism which focuses on the relation between relations. For example, the relation of the referent's (apple) characteristics corresponds with semantic relationship between the referent and chip symbol, otherwise known as Hockett's (1960) semanticity design. Thus, Sarah fulfilled Premack's relation to relation component and then later advanced to fulfill Premack's next linguistic step known as the representational capacity component which involves responding to representations of

various items or knowledge"(2). Sarah demonstrated her ability to respond to representations of oneself and of the various euriditic items during the following tests: the "this and that," and "yes and no."

In the "this" and "that" test, Sarah demonstrated the ability to comprehensively distinguish between two representatives meanings when they changed with the speaker. During the training, Sarah had to play the role of the producing speaker and the comprehensive listener which each selectively indicated the meaning of this and that. As the speaker, "this" referred to the object located near the distant trainer and vice versa when she was the listener. For instance, an object was displayed near Sarah and across from the trainer on some trials and conversely; she was then given the words "Sarah", "give", and either "this" or "that". When the object was placed near her she wrote "give Sarah this" and "Give Sarah that" when it was located near the trainer. She was then given three errorless trials which successfully indicated that she understood "this" as the name of the object near the speaker and "that" as the item located next to the listener (Premack 1976:282). Hence, Sarah's distinction of "this" and "that" as two different representational items was verified by her correct application of each into its designated location.

Sarah also demonstrated symbol comprehension through the interrogative "yes" or "no" test. The test began with the trainer who placed a red card on a green one and asked "is red on green?". Sarah needed to examine the placement of the cards, compare them with the sentence's meaning and reply "yes" or "no". Sarah usually responded accurately according to Premack(1976), yet she also

demonstrated an underlying comprehension. When the relation did not agree, she either responded "no" or occasionally altered the cards to agree with "yes". This reshuffling implies her understanding of "yes" and "no" as separate representational concepts(Premack 1976:30). The "this" and "that" and "yes" or "no" tests supported Sarah's ability to distinguish between representations of various items; while Gallup's(1979), experiments provided credible testimony of her ability to communicatively respond to her own body or behavior which completes the representational capacity's final criterion.

Gallup Gordon G's(1979) article "Self awareness" featured apes recognizing aspect of their faces via a mirror. Self awareness denotes mans ability to think or conceive of himself as a distinct element within the environment. Gallup(1979), states a mirror provides evidence of self-awareness. For example, "When a person observes his own image in a mirror, both the subject and object of perception become one and the same. Gallup(1979), believes that " time along with our parents taught us to identify ourselves with a mirror's image whereas an animal responds to his reflection through a variety of social responses that are typical of their species. Gallup(1979) applied this human chronological time model to an experiment involving four pre-adolescent chimpanzees, who were given individual exposure to a mirror for ten consecutive days. Their first few days consisted of responses that resembled the gestures made during the presence of another chimpanzee, nonetheless, After the third day, they began to respond to themselves as individuals. For instance, they utilized their reflection to view and experiment with

otherwise inaccessible information about themselves, such as grooming parts of the body they had never seen before, inspecting the inside of their mouths, and making faces at the mirror.

Indeed, the apes development of an individual identity represents a cognitive advancement for many reasons. For example., the evolutionary biologist Slobodkin(1975), believes "self awareness" has the potential to emancipate organisms intellectually from some of the deterministic forces of evolution"(Gallup 1979:421). Assuredly, the ability to reflect on oneself allows one to recognize, contemplate or alter his own existence. This ability implies that they are capable of abstract thought. This consciousness is necessary for associating an items meaning with its symbolic form. In other words, learning to speak or visually communicate requires an individual to recognize himself as a mentally existing organism. This self identity is also implied in the ASl trained apes sign for "me" which is distinguished by the sign(s) for "others" in signs such as you. We may also infer that they may comprehend the concept of "other" since they recognize their individuality. These distinctions also support their competence in discerning between the various symbols unique connotations. Sarah's skill at distinguishing and/or relating various items(Whether self knowledge or the "other") allowed her to advance to Premack's next components of causal inference and intentionality.

Sarah's intentions are related to the concept of self in that both are reliant on communication and causal analysis. Premack(1976); however, provides only hypothetical examples to support Sarah's intentionality. In one instance, he (1976:342) states" suppose Sarah asked a trainer a question, and the trainer answered but then stood

in front of the board, blocking Sarah's view of the answers". Any attempt Sarah made to discover the answer would be regarded as intentional. For example, if Sarah were to write "move", "please . . . I can't see the board" ; it would indicate her intentions(Ibid). Premack in my opinion does not adequately define or support this component and thus it is perhaps best to move on his next component of causal inference.

Premack(1976:4) states that "causal inference is a central facet of human mentation which presupposes human ontology, and all the key relations-agent-object-agent-patient, etc. that are the underpinnings of grammar". This traditionally held human specific trait also appears in nonverbal test(s) that are administered to the apes. In one test "the subject was given two objects, such as an intact apple and a severed one, and then asked to choose from alternatives that include a knife, a bowl of water, and a crayon. The subject correctly placed the knife between the whole apple and severed one which indicated a comprehension of the causal inference skill. In this test three out of four chimps chose the correct choice, a success ratio of 3-1 indicates that more than random choice was demonstrated. More importantly, the chimp's ability to correctly associate the relationship between the knife and sliced apple infers their underlying ability to comprehensively construct sentences. For instance, the knife test could be syntactically formulated as: "The knife cut the apple"(SVO). The chimp implicitly recognized the knife as the agent acting upon the whole apple(the object) which resulted in a severed apple.

We may infer that the ape performed A+B=C reasoning during this test. For instance, we may designate A as the knife; B as the whole apple; and C as the cut apple. The proficient chimp filled in the blank B slot in order to correctly complete the relationship. Sarah's causal inference proficiency also allowed her to tackle the concept of the Conditional or "if . . . then" sentence structure. For instance, when Sarah was presented with a series of sentences such as "Sarah take apple?", "Mary give chocolate Sarah" , she successfully placed the symbol for the conditional between them to receive a chocolate"(Linden 1974:177). Sarah, thus realized that the second sentence's reward was contingent upon the placement of the "if . . . then" between both sentences. Sarah's intentionality was inherently implied within this causal inference example. Denotatively, her intentions would reveal her desires, aims, and etc. For instance, Sarah's placement of the "if then" between "Sarah take apple?" and "Mary give chocolate Sarah" displayed Sarah's desire (intentions) for the reward(chocolate). Thus, these sentences demonstrate a causal inference relationship between the antecedent and the consequent. Premack(1976:336) concludes" only a species that made a causal analysis of its experiences would use sentences of this form productively.

The third version accompanies the second version and displays no initial demonstration but instead requires the subject to place chips from a bundle into a logical sequence of three chips. Premack's(1976) subjects accurately produced three slots in sequence 15-25% of the time(6). This three item non-verbal sequence appears to be an abstract replay or description of the

immediately preceding event and Premack(1976) believes that this act is comparable to verbal self-description which is similarly seen in these animals(6). For instance, the chimps Elizabeth and Peony formulated their plastic chips into the sequence"Elizabeth apple cut" or "Peony apple insert" after the instructor poked a knife into the apple(ibid). Premack(1976) concludes "When words are present, the animals may use them descriptively but when words are not present, the chimpanzee appears to use abstract nonverbal sequences in the same descriptive way as the words"(6). The chimps act of correctly formulating a descriptive sequence corresponds with Hockett's *duality of pattern* design.

For instance, the chimp's ability to gather three chips from a bundle and correctly place them in sequence describing their instructor's previous scene follows this design in that the bundle of ideographic chips corresponds with the small meaningful units while the ape's syntactical sequence agrees with the infinite number of potential meaningful messages. Sarah next demonstrated her ability to create new and different sentences from a basic vocabulary. For example, Premack(1976) believes that "Sarah's ability to recognize and state that a large person and large rock are similar in largeness, or that a green leaf and a green liquid are similar in greenness, indicates that she can productively apply the concepts of "color of" and "size of" in a productive way(Linden 1974:175). The scientific world traditionally denied the chimp the ability to apply semantics such as green toward green leaf or liquid; however, Sarah's competence allowed her to look past surface phenomena and instead concentrate on the underlying blocks (such as greenness) that make

up this particular message. Sarah was consequently able to perceive her environment in terms of building blocks and at will apply them to new settings.

The creation of this concept supports Sarah's *displacement* capability in that the meaning was ultimately derived from the mind which is in itself a source remote from time and/or space. In other words, no one knows exactly where or how a new concept is generated so we may infer that new ideas are oblivious to time and space. Indeed all concepts possibly apply to this oblivious realm yet we may not have to dwell on this intuitive explanation since we do have other more clearly defined examples. In one example, Sarah asked Tim to "move the milk behind the room, although the milk had not yet been brought to the room(Rumbaugh 1977:178). This statement requested a non-present object which is displaced from Sarah's immediate temporal surrounding.

Nevertheless, these skills occurred during the presence of a trainer which may indicate cueing. This traditionally held ape linguistic flaw was disproved through a method called the dumb trainer. The dumb trainer was actually an individual who did not understand the chip's symbolic meaning so he/she associated a specific number with each chip when presenting each object(food) to Sarah. Sarah requested the object in front of her by placing a four word sentence on a magnetized board; the instructor then, translated the column of words into a numerical sequence. This numerical sequence was read aloud via a trainer who judged whether or not Sarah inquired appropriately and then relayed either "yes" or "no'

for Sarah's retrieval of the designated item. Sarah accurately responded 82% of the time during three such tests(Premack 1976:33)

These results were however criticized by Cambridge Authority R.A. Brown(1973) who proposed that Sarah memorized the tests 58 sentences via cues from her trainer(Linden 1974:177). Premack(1976) acknowledges this possibility but states "This is almost impossible since Sarah had experienced over 2,600 different sentences that included these 58, prior to their reintroduction during the current tests(ibid). Sarah would then had to have predicted these 58 out of 2,600 before the new test's introduction(ibid). Premack(1976) next reiterated that "25% of the 58 sentences were new, yet Sarah showed no great differences in answers between the old(76%) and the new(74%) sentences(177). Sarah's accuracy rate therefore should not be held a fallacious on account of Brown's preconceived assertions. In fact, it appears that Sarah has undergone three stages of sentences development and comprehension.

Sarah first learned how to comprehend synonymous sentences in three different ways. During the first procedure, she made same-different interrogative judgments about a given pair of sentences. Secondly, she had to choose one sentence out of several alternatives and match its meaning with that of a corresponding test sentence. In the third test, she was required to create a sentence from a group of words that matched the test sentence's meaning. All three tests underwent at least five errorless free tests.

Sarah's first test developed as an outgrowth of the interrogative which is a word used to ask the questions: Who?, What?, and Which?. The interrogative is a token that means" question mark" when placed between two similar or different objects. For instance, when asked to relate the sentences "apple is red?" , "Red color of apple?", she decided that the sentences were the "same" by replacing the interrogative with the chip signifying the same"(Linden 1974:177). She also replaced the interrogative with a token meaning different when the sentences "apple is red?" , "apple is round?" , were comparatively introduced(ibid). She also occasionally produced the synonym "no same" for the word different while undergoing the same testing conditions as listed above(Linden 1974:177).

The second test involved presenting a sample sentence such as "chocolate is brown to Sarah who needed to respond with a correct sentence such as "same brown color of chocolate" which was one out of two choices(Premack 1976:285). Sarah achieved an 87.5 accuracy rate during eight trials (ibid).

In the third test, Sarah was given a sample sentence such as "apple is red" and expected to create a connotatively similar sentence from a choice of following six words: brown, color of, red, chocolate, and apple. A correct sentence for the above sentence would read "red color of apple"(Premack 1976:287). She accurately created such corresponding sentences 88% of the time(Premack 1976:288).

The chimp is thus capable of deciding whether or not a pair of sentences are different or the same, and matching meaningfully similar but structurally different sentences together and creating the former from the scratch. Sarah then understands how to produce,

join, and match sentences which is a whole essential to grammar. In particular the third test demonstrates her ability to produce sentences from a selection of choices and is known as Hockett's Duality of Pattern design(grammar). Nevertheless, Sarah's reliance on the presented testing chips prevented her from fulfilling Hockett's(1960) productivity design ; that is her choices were limited to the symbols placed before her. Thus, Sarah, unlike Washoe and Koko, was not able to generate novel words or sentences yet some of her syntax did meet ASL' descriptive word order criteria.

David Premack's(1976) method, like ASL, also did not utilize articles. In his study he accepted the following word orders: SVO, VOS, and VSO while dismissing the SOV as a true lexigram form. Sarah produced the following sentences: "Grape is green"(SVO);"apple is round"(SVO)(Premack 1976:287); "Sarah give grape"(SVO)(97);"Give Sarah banana apple"(VSO(S))(97); and "Give orange Sarah"(VOS)(97). In one study of strings, Sarah correctly produced 405 out of 409 strings which left only four flawed SOV forms. All of the above sentences satisfy ASL's criteria for word order. In another sentence, Sarah created a more complicated word order that involved the addition of an indirect object: "Mary give Sarah apple" (SV(IO)O)(Rumbaugh 1986:8).

Sarah also demonstrated sentence growth stages. Sarah, like children, underwent three stages of sentence production. During these tests, the instructors always presented sentences in one order such as "Sarah Apple take"; yet Sarah responded with her own different systematic order. During the first phase, Sarah initially produced "Sarah apple give" when introduced to the representative

sentence of "Give apple Sarah". Toward the end of the second month, Sarah produced "Give Sarah apple" which was marked by the reversal of the object and subject. In the next transformation, Sarah accurately produced the representational example: "Give Sarah apple Sarah" for a period of three months(Ibid).

In the second phase, Sarah produced the same word order as the first phase's second string(Give Sarah apple). This reduplication of the first phase's second string indicates the subjects renewed confusion over the same representation. Fortunately, Sarah's competence returned during the next string when a trainer introduced "Mary give apple Sarah" which Sarah successfully reiterated(Premack 1976:319).

The third phase utilized the same string as the preceding representation and demonstrated similar results for a period of 10-12 months. The subject's consistent sequential response infers that they possess a schema, that assigns an interpretation to an otherwise infinitely ambiguous sequence. Moreover, these tests indicate Sarah's gradual comprehension of the representations which similarly occurs during a child's linguistic development. For instance, in the first phase Sarah produced two inaccurate representations until achieving competence. She was thus experimenting with word order as children do. By the beginning of the second phase, she began demonstrating additional confusion which similarly occur during a child's linguistic development. For instance, during the first phase Sarah produced two inaccurate representations until achieving competence. She was thus experimenting with word order as children do. By the beginning of the second phase, she began

demonstrating additional confusion which nonetheless was reciprocated in the next string. The third stage revealed Sarah's maximum memory level which was evident during her 10-12 months of production proficiency (Premack 1976:319).

Sarah also mastered compound sentence structures. She was first taught two sentences: "Sarah insert apple pail" and "Sarah insert banana dish"(ibid). Eventually she removed the repetitions of the words "Sarah" and "insert" to produce the sentence "Sarah insert apple pail banana dish"(ibid). Sarah's comprehension indicated that she understood the hierarchical nature of sentence formation in that the word "insert" is at a higher level of organization and refers to both "apple" and "banana"(ibid). Premack(1976) believes that "Sarah like children recognizes the various levels of sentence organization which is evident when the subject dominates the predicate and the verb"(Linden 1974:179).

In conclusion, Sarah's performance was summarized by Premack(1971) who followed Piaget's dictum which states "teaching language to an animal consists largely of mapping the animal's already existing knowledge"(in Linden 1974:179). Consequently, she had successfully mapped her pre-language experiences. For instance, Sarah had to learn the relationships that individually apply to the concepts of the conditional, same-different, the dimensional, the interrogative, the negative, and the compound sentence. Premack(1977), used these non-linguistic devices to test Sarah's knowledge of these concepts before he attempted to these relationships in his token language. Sarah began her training at the age of five and within 18 months she had achieved the level of

competence of a child of about the age of two or three(Premack 1976:179).

Brown (1974) also examined Sarah's performance and concluded that she, like Washoe, reached the first linguistic level of a child. He; however, was not certain whether or not Premack's data indicated what he thought it did. For example, as a behaviorist, Premack(1971) believes that "teaching language to a chimp involves breaking complex actions down into their behavioral constituents and then creating the appropriate training program to inculcate the action, piece by piece, into the animal"(in Linden 1974:180). Brown(1974) believes that this approach involves an arbitrary series of movements which in itself does not constitute language. For example, Brown(1974) states "Sarah's mastery of the compound sentence was merely a contrived feat and not the particular application of a general grammatical structure"(ibid).

Brown (1974) charged that Sarah's communication may be conceived of as a "set of carefully programmed language games"(in Linden 1974:181). He cites her consistent 75-80% accuracy rate during all the phases of interrogative complexity and the tests format of introducing one language problem at a time as evidence of her rote memory skills. Premack(1976); however, is not concerned about whether or not Sarah is fabricating a trick or constructing language since he asserts" there is no real difference between the two. He describes "the mind as a device for internal representation and asserts that because the mind is this kind of device, every response to a stimulus is a potential word. The process by which a response becomes a word", says Premack, "is no different that the

one by which a pigeon learns to peck a key when it is lighted, and concludes that the procedures that will train a pigeon to this will also produce words"(Linden 1974:182).

Premack's token language might be described as a series of deductions which enable her to receive treats. Sarah's language might also be best considered a matching test that measures intelligence rather than language. Nonetheless, Sarah did fulfill every one of Premack's exemplars on a consistent basis and all of Hockett's designs with the exception of the productivity design and the previously mentioned ones found in the comparative introductory section. She demonstrated word comprehension through match to sample tests which showed her ability to associate the referent with its arbitrary symbol and still correctly related the former's characteristics with that of the latter's. This competence corresponded with Premack's relation to relation component. She demonstrated the representational components prerequisites during the "this" and "that" and "yes" and "no" tests; and in Gallup's(1979) primate experiments. This component ubiquitously complements Premack's(1976) components of intentionality and causal inference.

The true intentions of a primate speaker would determine whether or not an ape understands what he says? This comprehension was apparent within Sarah's "causal inference" skill. For example, when Sarah placed the conditional "if-then" between the sentences "Sarah take apple?" and "Mary give chocolate Sarah" she earned a chocolate(Linden 1974:177). Thus, Sarah's desire(intention) for the chocolate relied on her successful completion of the task. This connection revealed the apes comprehension of cause and effect, a

feature that also supported her adeptness at productivity and grammar. In one example: Elizabeth's formulation of the sentence "Elizabeth apple cut" occurred after her instructor completed this act(Ibid). Hence, Sarah's ability to gather these three symbols from an assortment of chips and create coherent(descriptive) syntax corresponds with grammars essence. Sarah demonstrated the novel use of these previously learned symbols when she applied the concept of green to both a leaf and green liquid.

### *THE LANA PROJECT*

Primatologists Sue Savage and Duane Rumbaugh et al. (1973) developed a method of analyzing ape-language acquisition that combined many features of the approaches undertaken by previous researchers. They utilized a mode of communication which gathered data in a manner that did not rely upon an instructor's sign or plastic chips. Instead, a computer screen and key board replaced the potential cuer and thus avoided any possible evidence of cueing the chimp to respond to the lexigram(s) while under the trainer's presence. After conducting an analysis of the chimpanzee language reports of the Gardners, David Premack, and Roger Fouts, Duane Rumbaugh(1977) formulated the Lana project during the fall of 1970. In the early 1970's, the team began communicating with chimps through computers using a language designed by Ernst Von Glaserfeld who labeled the project's language Yerkish, in honor of Robert M. Yerkes, the founder of the laboratory within which the LANA project was conceived and conducted(Premack 1986:89).

In this system, Rumbaugh utilized 2 keyboards, a monitor, and a symbol generator. One keyboard was utilized by Lana inside her

cage along with the sole monitor and generator while the trainer made use of another outside. The monitor displayed messages from both parties. The keys are laden with miniaturized lexigrams which are engraved onto the top surface of the key. The keyboard was capable of holding 60 words yet Lana later expanded her vocabulary to 130 words. The trainer submitted his statements via a keyboard that depicted messages in the form of horizontal sentences along the screen. The actual symbols placed on the board were originally composed of nine distinct elements which Rumbaugh refers to as lexigrams. Since there are only nine possible elements to combine, each word is made up of similar sub components. Hence, the pattern is important while the orientation is not.

These nine elements used singularly and in combinations of two, three, and four would yield 225 individually different lexigrams which would more that suffice as a vocabulary limit(Rumbaugh 1977:94). Three colors were also added and superimposed on one another to create three intermediary colors. The colors were also used to classify items. For example, a green background indicated "parts of the body"(ibid). More recently, Rumbaugh(1986) developed the capacity to project keyboard symbolism on TV monitors and thus no longer needed to be limited to the original element. In this setup, the subject merely has to touch a particular key to activate the computer. Initially, all of the keys remain dimly lit which means they are active and available for use. Any key that consequently appears on the monitor. The symbols appear in a left to right sequence and once the message has been completed a touch to the solid yellow key causes all of the unused keys to darken. As a result,

the message stands out clearly from the rest of the symbols on the board and thus becomes highly visible to both the listener and receiver. This enhances the acquisition of new symbols.

They began teaching Sarah the concept of *association* by sitting in front of the keyboard with her. The object was shown to Sarah who was encouraged to light a symbol. If the chimp selected the correct symbol she was rewarded with food or social praise. If she failed the test repeated itself. To enhance this association, initially only one key was available, thus, the chimpanzee did not have to make a choice, he needed only to learn to respond to the presentation of an object by pressing a key. Once the ape reliably pressed the appropriate key, a second symbol was introduced until the ape established more accuracy. The next stage involved independently displaying one of the items while both keys were lit. When the chimp consistently chose the correct key she moved on to the next object. When the third object was introduced, three keys lit up which required the ape to correctly choose one out of three choices. After spontaneously choosing the correct choice, the ape was introduced to a fourth object and symbol; a fifth, sixth, and so on, until the accuracy rate fell. Eventually, Lana managed to grasp a vocabulary of 130 symbols while undertaking this procedure(Rumbaugh 1986:61). Lana's successful association of the symbol with its visual image allowed her to attempt the next linguistic level known as meaning.

This semanticity was revealed within her syntactic statements. Lana created sentences in the form of requests. Indeed her computer terminal was designed to accept only grammatically

correct sentences. She learned strings of lexigrams in order to manipulate food vendors and mechanical devices in her environment. These predetermined sentence formations consist of examples such as "machine give piece of apple" and "machine make window open"(Rumbaugh 1977:8). Although, the computer accepted only grammatically correct responses, I felt it necessary to comparatively judge her word orders through Fischer(1981), word order criteria which accordingly was utilized during the former apes performances. Here are some of Lana's word order creations: "Please machine give M&M"([IO] SVO)(Rumbaugh 1977); "Please machine make window open"([IO]SVO)(ibid); "Please Tim give milk out room"(SVO)(ibid). In all three of these examples the indirect object "Lana" is implied in the word please. These word orders are acceptable and it should come as no surprise since the lexigram machine is geared to respond to only correctly created sentences. This probably motivated Lana to respond accurately in order to fulfill her requests.

These requests exemplify Lana's intentions and semantic competence. For example, she understood that the machine was stocked by humans so when the machine became empty, she directed the following request to her instructor" Please Tim give milk out room"(Rumbaugh 1977:8). When Lana requested this activity and object from her trainer, she undertook a form of coherent communication. Nevertheless, critics have traditionally pointed out that chimps tend to use only symbols that correspond to food, play, contact, or change of activity" as the above example demonstrates(ibid). However, Sarah's next spontaneous request of "

machine make window open" involves none of the above weaknesses and thus is instead a request for a novel action(ibid). Hence Sarah, has now willfully attached the abstract concept of (open) to a referent symbol since no food gift was initially utilized to entice her request.

These novel requests pertain to grammar and Hockett's *productivity* design. Generally, Lana's multiple strings function to request something from either her computer-designed environment or her human companions. It was vital that she associated different outcomes with different individual lexigrams in order to seek the events she enjoyed(tickling, going outdoors, seeing movies, etc.) and to receive the food and drinks she desired(Rumbaugh 1986:244). The creation of old strings into new ones corresponds with productivity while the fabrication of these individual lexigrams into grammatical utterances correlates with grammar. Hence, questioning Sarah's grammatical ability is irrelevant since the computer only responds to grammatically accurate sequences. An example of Lana's productivity occurred when she formulated two previously learned words(chow and water) into a new combination that appeared as follows "Please machine give chow water"(Rumbaugh 1986:166). The "chow" stands for a commercial pet preparer which Sarah probably wished to mix with water until she reached the desired taste. The best evidence for displacement occurred when Sarah asked Tim to "move the milk behind the room(Rumbaugh 1977:178). This statement requested a non-present object which is displaced from Sarah's immediate temporal surrounding. Lana, perhaps, best

demonstrated her productivity proficiency during a conversation with her trainer-Tim, (Rumbaugh 1986:245) which relates as follows:

Tim. Lana want what [to] drink(9:35)

Lana. Lana want drink milk in machine(9:36) (Tim puts half a pitcher of milk into the dispenser and leaves the other half outside Lana's room in full view.)

Lana. Please machine give milk (9:40-9:44-repeatedly until the milk dispenser is empty)

Lana. You put milk in machine(9:44)

Tim. Milk in machine(9:44)

Lana. You put more milk in machine(9:44)

Tim. Yes(9:45)

Lana. Please machine give milk(9:46)

Hence, Lana's requests were new formulations of previously learned lexigrams. Lana also produced her food symbols at will, and in novel ways, when the normal routine became altered, such as when visitors periodically entered the lab(ibid). The above conversation provided further evidence supporting Sarah's semantic competence.

For instance, the symbol "milk" was tested in the above sentences. Lana named or requested "milk" even when it was paired with other foods. Her ability to distinguish between these various foods indicates that she grasped the symbols specific semantic context. She also was able to rearrange one lexigram within a series of identical strings during her requests: "please machine give milk"; "please machine give juice", etc.(Rumbaugh 1986:244). These examples further prove her ability to discriminate between various terms. Lana, also learned to identify or "name" objects by specific lexigram

even though she was not requesting these items, nor demonstrating a desire for them. For example, when asked to give the color of an item, Lana often gave its specific lexigram name. She later progressed to distinguish between questions such as the following: "What color of this"?, "What name of this"?, and achieved an 92% accuracy rate during their corresponding tests(Rumbaugh 1986:244).

Initially, Lana had no trouble identifying objects that were presented before her yet when they were removed she often could not respond to a request that involved them. For instance, Lana, was unable to recall the word for "wrench" when she was asked for the tool(Rumbaugh 1986:248). The break between Lana's skills of naming and requesting items were terminated after she was taught to point to the object that she desired. This pointing technique enhanced her recall of the correct symbol, which she then utilized to request the object. In summation, Lana could repeat, rearrange, and often respond correctly to the experimenter.

In a Rumbaugh (1986:51) test, Lana demonstrated the ability to categorize objects according to their function. In the test, Lana was required "to sort between three foods (orange, bread, and beancake) into one bin, and three tools(key, money, and sticks into another). After training, she was given a food or a tool and asked to place it in the correct bin which Sarah did on a consistent basis. The next test, required Lana, to select the appropriate "food" or "tool" lexigram after accurately putting its corresponding food or tool symbol into its proper bin, a task that she consistently managed. After Lana learned this skill, the bins were removed, and Sarah was asked to label the items categorically without sorting them. Sarah demonstrated an

accuracy rating of 90%, a rate which Rumbaugh(1977:253) says indicates legitimate competence. Lana's ability to distinguish between the representations of various items(as noted above in the examples of food and tool) through their functional significance. Moreover, this food symbol-type of food association involves matching the symbol with its designated meaning and is a feature that connotes "reflexivity". This Hockett(1960) design emphasizes the language holder's capability of communicating about communication. The matching of the general symbol for "food' with that of any one of its corresponding lexigrams, exemplifies Sarah's ability to visually express a symbol(s) along with its designated connotative attributes.

Further support of Lana's linguistic competence could have been revealed within Hockett's(1960) *prevarication* design, yet I found no adequate evidence. The Lana project was designed to advance the previously developed ape language techniques and invent new methods to counter their flaws. She fulfilled the following replications of Premack's experiments: the "Yes and No", Name of this", and color distinguishing. Lana also demonstrated proficiency in several of Rumbaugh's(1977) training procedures which involved learning to read and write with lexigrams and correctly use the concepts of "to" "more" ,"less", and etc. Rumbaugh also prevented the ape from relying on human cues through the use of a computer monitor and keyboard as communicative devices. Koko, Washoe, and Sarah also underwent non-cueing experiments. The ASL apes successfully completed the double blind fold test, while Sarah competently completed the dumb trainer test.

## *FINDINGS*

The crux of this study sought to answer the following questions: Do primates use signs in ways that are comparable to humans? That is, do primates know what they are signing. Do they think when they communicate? To address these queries, I needed to determine whether these primates' use of representations are extant and operating. The comparative analysis indicated that apes can mentally manipulate abstract concepts that have been defined by means of an arbitrary code. This manipulation involves mentally scanning a set of symbols and cognitively selecting one on the basis of its specific linguistic context; for instance, "answering"? "What name of this-that's blue" when several different objects are available demands more that just matching a vocabulary that contains a set of words/lexigrams)(Rumbaugh 1977:204). Thus, a goal directed visual search must be initiated that is based on information deduced from the linguistically coded question. The apes results proved to be linguistically coded and expressed, which accordingly established their true linguistic comprehensive production.

## *CONCLUSIONS*

Although breakthoughs in ape language studies are still evolving, the linguistic skills demonstrated by Washoe, Koko, Sarah, and Lana involved different methods, and when studied and compared, they yielded many commonalties.. These apes learned word representations in different linguistic forms (ASL signs, lexigrams, and chips). In the beginning, their slow progress evolved into the learning of word meanings within a single presentation. Nevertheless, their training and subsequent testing percentages

indicate that they consistently did learn to use arbitrary representations in a meaningful context. Yet, this finding alone does not prove that the meanings of words for apes coincide with man. They were; however, similar enough to permit interpretable conversations between these two species.

In any event, ape linguistic abilities are far below the level of adult communication and probably correspond to the intellectual level of a normal two year old child as Brown(1973) and the Rumbaughs' findings indicate. Nevertheless, these apes spontaneously create word order units (whether it be signs, lexigrams, or chips) that grammatically corresponded to Fischer's(1981) various (SVO) word orders. All apes except possibly Sarah demonstrated the ability to combine two or more familiar terms into new ones; examples occurred when Lana called a "fanta orange drink-coke"(Rumbaugh and Gill 1977:179), when "Washoe's signed "waterbird" after being asked to name a duck"(Fouts 1974), and when Koko, personally lamented "Think eye ear nose boring" in response to her body naming exercise(Linden 1974:125). Premack's chip symbology limited Sarah from creating new utterances out of previously learned concepts since she only had access to a minimal amount of chips(usually 3). I found no definite evidence among the apes to indicate prevarication competence, yet the rest of the Hockett's designs were for the most part displayed or held visually compatible throughout this paper's data.

These apes also demonstrated displacement competence; examples include Sarah's request to "move the (unpresented) milk behind the room"(Rumbaugh 1977:178) and Koko's signing of "home" while a passenger in a car bound for the Pattersons home (1986:5). Moreover, the apes performance and/or language fulfilled most of Hockett's remaining designs: the vocal auditory channel, rapid fading, interchangeability, broadcast transmission and directional reception, specialization, discreteness, traditional transmission, total feedback, reflexiveness, and learnability.

If the apes had rapidly fulfilled their instructors' language criteria, then it would imply that they were merely learning a game based on reinforcement yet several comparative studies revealed that they underwent developmentary linguistic stages. Washoe's performance often parallels those of Brown's(1962) child acquisition stages. Moreover, Washoe completed Brown's (1962) first two levels and all five of his MLU stages. Koko, also fulfilled child developmentary language stages by successfully performing all of Dore's child acquisition stages which consisted of repeating, answering, requesting, labeling, action, requesting an answer, calling, greeting, protesting, and practicing. These accomplishments, did not however prevent various critics from scrutinizing their work.

As a critic of primate language ability, Terrace (1974) formulated conclusions that have been discounted by not only primatologists but by himself. For instance, Washoe, like Koko, produced novel statements which discredits the notion that she is merely engaging in human cued-redundant behavior. After a considerable lapse in training, isolated chimps at the Institute of Primate Studies

demonstrated memory capacity without the need for rewards. Moreover, Washoe's apparent interruptions during the Gardners' (1974) film entitled, "Teaching Sign Language to a Chimp named Washoe" were according to Fouts(1975) and many others attributable to the miscuing of her instructor-Beatrice. Furthermore, Terrace's own teaching methods manifested intrinsic flaws that probably resulted in Nim's weak linguistic performance. In comparison to Washoe and Koko, Nim went through numerous instructors, training variances and environments within a shorter period of time. Indeed, Terrace(1974) later admitted that his approach possessed flaws which may have caused his data to reflect poor ape linguistic competence. As a result, Terrace(1986) later decided to assist in the work of the Rumbaughs.

The next ape language adversary-Brown(1970) criticized Washoe and Sarah's linguistic proficiency. He (1973) believed that Washoe only completed his first linguistic stage yet the data places her competence in the first and second levels along with all five of his MLU stages. In any event, both the Gardners(1973) and Brown(1973) agree that Washoe is proficient in the first stage.

In regard to Sarah, Brown(1974) concluded that her communication is merely a set of programmed language games (in Linden 1974:181). Contrary to this claim, Premack(1971) asserts language does not involve fabricating conceptual representations in the mind which are analogously similar to that of a pigeon who learns to peck (in response) to a key(the stimulus) when it is lighted. Sarah, like Washoe, Koko, and Lana, fulfilled the majority of her instructors' language criteria which were established in Premack's

exemplars and intertwining mechanismal components. Sarah completed these features through verbal and nonverbal interrogatives.

The apes reliance on these visual languages is of course a human creation; it is this human environment of instructors, buildings, learning apparatus, etc. that promotes the development of ape language skills. Man's development of the most sophisticated language system in the world is attained only through cultural exposure and our supposedly more distant relatives of the Pongidae family portray these skills at a more rudimentary level. Thus, the domestic ape's language development suggests that all apes possess inherent rudimentary language ability potential.

## *REFERENCES CITED*


Bornstein, Harry and Karen L. Saulnier
1986 *Signing: Signed English a Basic Guide.* New York: Crown Publishers.

Brown, Roger
1962 in *The Education of Koko.* (1981). New York, New York: Holt, Rinehart, and Wilson.

Brown, Roger
1970 The First Sentences of Child and Chimpanzee. In *Psycholinguistics: Selected Papers.* New York: Free Press.

Brown, Roger
1973 *In Primate Behavior* (1982). James Fobes and James King. p.365. New York: Academic Press.

Brown, Roger
1974 *A First Language: The Early Stages.* Cambridge: Harvard University Press.

Dore, John
1960 *In Gorilla: Journal of the Gorilla Foundation.* Penny Patterson (1987). Dec. Vol. 10, No. 1.

Dore, John
1973 *In Gorilla: Journal of the Gorilla Foundation.* Penny Patterson's. Dec. Vol. 10, No. 1.

Fischer, S.
1975 In *American Sign Language Syntax (1980).* Scott K. Liddel. p.3. The Hague: Mouton Publishers.

Fobes, James and James King
1982 *Primate Behavior.* New York: Academic Press.

Fouts, Roger
1975 *In Apes, Men, and Language* (1974). Eugene Linden. New York: Penguin Books Inc.

Gallup, Gordon G. jr.
1979 Self Awareness in Primates. *American Scientist*, July-August: Pp.417-421.

Gardner, Allen R. and Beatrice Gardner
1974 *Teaching Sign Language to the Chimpanzee: Washoe.* b/w film. University Park, Pennsylvania.

Gardner, Allen R. and Beatrice Gardner
1976 *First Signs of Washoe.* New York: Time Life Multimedia.

Greene, David
1987 Personal Communication/Interview with a Physical Anthropologist. Boulder, Colorado.

Hockett, Charles Francis
1960 The Origins of Speech. *Scientific American*: September.

Hockett, Charles Francis
1967 *Language, Mathematics, and Linguistics.* The Hague: Mouton Publishers.

Lemmon, William
1987 *In Apes, Men, and Language* (1974). Eugene Linden. New York: Penguin Books Inc.

Lenneberg, Eric
1967 *Biological Foundations of Language.* New York: Wiley.

Liddel, Scott K.
1980 *American Sign Language Syntax.* The Hague: Mouton Publishers.

Linden, Eugene
1974 *Apes, Men, and Language.* New York: Penguin Books Inc.

Linden, Eugene
1986 *Silent Partners.* New York: Random House Inc.

Patterson, Francine and Eugene Linden
1981 *Education of Koko.* New York: Holt, Rinehart, and Wilson.

Patterson, Penny
1986 *Gorilla*: Journal of the Gorilla Foundation. Dec. Vol. 10, No. 1.

Patterson, Penny
1987 *Gorilla*: Journal of the Gorilla Foundation. Dec. Vol. 10, No. 2.

Premack, David
1976 *Intelligence in Ape and Man.* Hillsdale, New Jersey: Halstead Press Division of John, Wiley, and Son.

Premack, David
1986 *Garagail or the Future History of the Animal Language Controversy.* Cambridge, Massachussets: MIT Press.

Rachels, James
1990 *Created From Animals.* Oxford University Press.

Remmel, Linda
1987 Personal Communication/Interview with an American Sign Language (ASL) Specialist. Port Orchard, Washington.

Rumbaugh, Duane; Sue Rumbaugh and John L. Scanlon
1982 The Relationship Between Language in Apes and Human Beings. *In Primate Behavior.* James Fobes and James King. New York: Academic Press.

Rumbaugh, Duane
1986 *Language Learning by a Chimpanzee: The Lana Project.* London, England: Academic Press.

Terrace, Herb
1986 *Nim.* New York, New York: Alfred A. Knopf.

## *FIGURES*

Figure 1= Nonverbal ASL cues: Plate 1./Background 3 (Liddell 1980:3).

Figure 2= Keywords to Word Descriptions (Bornstein and Saulnier 1986:XX).

Figure 3= "Name of" and Metalinguistics: Figure 8.3 (Premack 1976:170).

Figure 1

*Background* 3

q
WOMAN FORGET PURSE

Plate 1.

From (Liddell 1980;3) Nonverbal ASL cues.

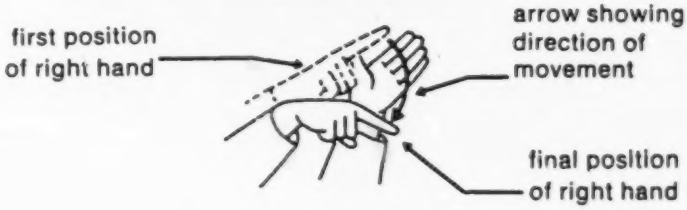
Figure 2

# KEY to WORD DESCRIPTIONS

In order to use this book easily and effectively, you should be familiar with the names of your fingers, the manual alphabet, the signs for the numbers one through ten, and certain hand-shapes that are frequently used when making the base signs.

- **RH = right hand**
- **LH = left hand**

## ILLUSTRATIONS




## HANDSHAPES

Sample letter shape A.
See complete alphabet
on page xiv.

Sample number shape 1.
See numbers 1-29 on
page xviii.

**open B** **bent B** **bent V** **claw shape** **flat O**

xx From(Bornstein and Saulnier 1986;XX)

Figure 3



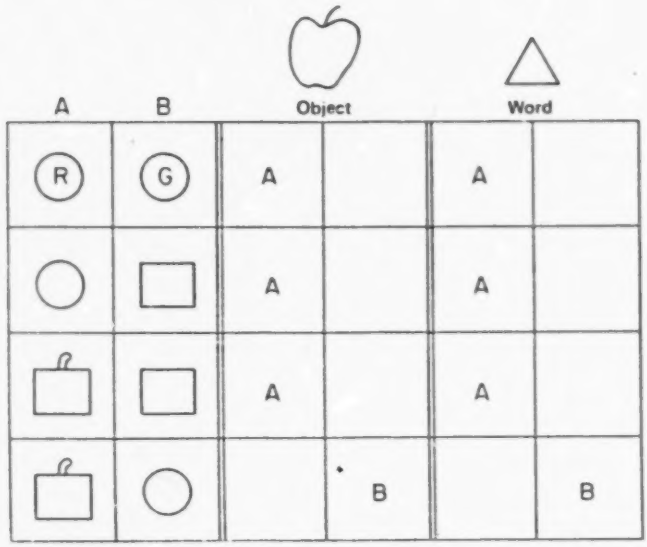



FIG. 8.3 Features analysis of the object apple and the word "apple" (Premack, 1970).

From (Premack 1976;170;figure 8.3)